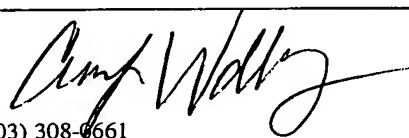


## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 12504.464	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US03/23426	International filing date (day/month/year) 25 July 2003 (25.07.2003)	Priority date (day/month/year) 26 July 2002 (26.07.2002)
International Patent Classification (IPC) or national classification and IPC IPC(7): B01L 3/00 and US Cl.: 422/102, 129, 131		
Applicant ARIZONA BOARD OF REGENTS		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>6</u> sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>4</u> sheets.</p> <p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of report with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input checked="" type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>		
Date of submission of the demand 25 February 2004 (25.02.2004)	Date of completion of this report 13 August 2004 (13.08.2004)	
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Jeffrey R. Snay  Telephone No. (703) 308-6661	

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US03/23426

**I. Basis of the report****1. With regard to the elements of the international application:\***

- ☐ the international application as originally filed.
- ☒ the description:  
pages 1-10 as originally filed  
pages NONE, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.
- ☒ the claims:  
pages NONE, as originally filed  
pages NONE, as amended (together with any statement) under Article 19  
pages NONE, filed with the demand  
pages 11-13/1, filed with the letter of 07 July 2004 (07.07.2004)
- ☒ the drawings:  
pages 1-5, as originally filed  
pages NONE, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.
- ☐ the sequence listing part of the description:  
pages NONE, as originally filed  
pages NONE, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.

**2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.**

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

**3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:**

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

**4. ☒ The amendments have resulted in the cancellation of:**

- ☐ the description, pages NONE
- ☒ the claims, Nos. 2 and 26
- ☐ the drawings, sheets/~~fig~~ NONE

**5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\***

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

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**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. STATEMENT**

Novelty (N)	Claims <u>9-11, 15, 17, 19, 22, 24 and 27-43</u>	YES
	Claims <u>1, 3-8, 12-14, 16, 18, 20, 21, 23 and 25</u>	NO
Inventive Step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1, 3-25, and 27-43</u>	NO
Industrial Applicability (IA)	Claims <u>1, 3-25, and 27-43</u>	YES
	Claims <u>NONE</u>	NO

**2. CITATIONS AND EXPLANATIONS**

Please See Continuation Sheet

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

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## VI. Certain documents cited

## 1. Certain published documents (Rule 70.10)

Application No Patent No.	Publication Date (day/month/year)	Filing Date (day/month/year)	Priority date (valid claim) (day/month/year)
US 6,673,620 B1	06 January 2004 (06.01.2004)	14 April 2000 (14.04.2000)	20 April 1999 (20.04.1999)

## 2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosureDate of non-written disclosure  
(day/month/year)Date of written disclosure referring to  
non-written disclosure  
(day/month/year)

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

**V. 2. Citations and Explanations:**

Claims 1, 3-4, 6-8, 13, 16, 18, 20 lack novelty under PCT Article 33(2) as being anticipated by Northrup et al. Northrup et al. teach the claimed microreactor including the claimed core body made of a non-ferrous metal defining a chamber (25) and having fluid passageways (22,23,24) from the chamber to the exterior of the core body, at least one controllable fluid supplies (19,20,21) adapted to supply at least one fluid at a pressure from about 0 psi to about 4,500 psi, access opening (14) for placing samples into the chamber and removing samples from the chamber, heater (Hc) adapted to heat from about 20 degrees Celsius to about 400 degrees Celsius, window allowing transmission of probe beam into and out of the chamber, and thermocouple.

Claims 1, 6-8, 16, 18, 20, 21, and 23 lack novelty under PCT Article 33(2) as being anticipated by Cutler et al. Cutler et al. teach the claimed microreactor (10) including the claimed core body made of a non-ferrous metal defining a chamber (12) visible through a window in the body and having fluid passageways (50) from the chamber to the exterior of the core body, at least one controllable fluid supply adapted to supply at least one fluid at a pressure from about 0 psi to about 4,500 psi, and access opening for placing a sample in the chamber and removing the sample from the chamber.

Claims 1, 3-4, 6-8, 13, 14, 16, 18, and 20 lack novelty under PCT Article 33(2) as being anticipated by Hayes et al. Hayes et al. teach the claimed microreactor (10) including the claimed core body made of a non-ferrous metal defining chambers (40-42) visible through a window in the body and having fluid passageways (70-72) from the chamber to the exterior of the core body, at least one controllable fluid supply adapted to supply at least one fluid at a pressure from about 0 psi to about 4,500 psi, heaters (50-52) adapted to heat the chamber to a temperature from about 20 degrees Celsius to about 400 degrees Celsius, thermocouple positioned in the core body near the chamber, sample holder (56) disposed within the chamber, and access opening for placing a sample in the chamber and removing the sample from the chamber.

Claims 1, 3-5, 12-14, and 20 lack novelty under PCT Article 33(2) as being anticipated by Borgialli. Borgialli teaches the claimed microreactor including the claimed core body defining a chamber (30) and having a fluid passageway (32) from the chamber to the exterior of the core body, at least one controllable fluid supply adapted to supply at least one fluid at a pressure from about 0 psi to about 4,500 psi, heater (51) adapted to heat the chamber to a temperature in a range from about 20 degrees Celsius to about 400 degrees Celsius, at least one fluid supply is coupled to the fluid passageway using a high-pressure fitting (34,36), well disposed within the core body without penetrating the chamber and having an opening to the exterior of the core body such that a thermocouple can be inserted into the core body near the chamber, access opening for placing a sample in the chamber and removing the sample from the chamber.

Claims 9-11, 15, 17, 19, 22, and 24 lack an inventive step under PCT Article 33(3) as being obvious over Northrup et al. or Cutler et al. or Hayes et al. or Borgialli. None of the previously cited references explicitly teach the windows made of moissanite or sapphire. Since it is desirable to provide a strong, leak-proof, transparent window, it would have been obvious to one of ordinary skill in this art at the time this invention was made to provide the window of a microreactor with the claimed material of construction. None of the

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(To be used when the space in any of the preceding boxes is not sufficient)

previously cited references explicitly teach the chamber with a volume of about 0.1 ml. Since it is desirable to effectively and efficiently accommodate reactions, it would have been obvious to one of ordinary skill in this art at the time this invention was made to provide the chamber of a microreactor with the claimed range of volume given the large range. None of the previously cited references explicitly teach the core body comprising a corrosion resistant material, Hastelloy C-276, or Be-doped copper. Since it is desirable to provide a rust-proof, pressure-resistant, and chemical compatible core body to accommodate particular reactions, it would have been obvious to one of ordinary skill in this art at the time this invention was made to provide the core body of a microreactor with the claimed construction materials. None of the previously cited references explicitly teach a sample holder comprising a corrosion-resistant material or moissanite or sapphire. Since it is desirably to use a strong, pressure-resistant, chemically compatible, rust-proof material given that the reactor may be subjected to many liquid reactions, it would have been obvious to one of ordinary skill in this art at the time this invention was made to provide the sample holder of microreactor with the claimed materials of construction.

Claim 25 lacks novelty under PCT Article 33(2) as being anticipated by Brennan. Brennan teaches the claimed method of investigating the reaction or properties of materials in situ including the claimed method steps of providing a microreactor with a core body defining a chamber and fluid passageway in communication with the chamber and adapted to be coupled with one or more fluid supplies, placing sample materials into the chamber, sealing the chamber, evacuating the chamber to purge wastes, coupling a supply of fluid to the fluid passageway, supplying one or more fluids to the chamber under controlled conditions such as pressure from about 0 psi to about 4,500 psi, and observing a reaction of the sample materials and fluids.

Claims 27-43 lack an inventive step under PCT Article 33(3) as being obvious over Brennan. Brennan does not teach heating the chamber from about 20 degrees Celsius to about 400 degrees Celsius; observing a reaction by x-ray beam, infrared light, Raman spectroscopy with laser illumination, or neutron spectroscopy with a beam of collimated thermal neutrons, NMR spectroscopy; supplying fluid in a controlled amount under controlled pressure and temperature; and supplying a fluid in a supercritical fluid state, liquid-rich phase, or gas-rich phase. Since a reaction may require certain temperatures, pressures, and amounts of sample and reagents, it would have been obvious to one of ordinary skill in this art at the time this invention was made to provide the claimed method step of controlling the temperature and pressure of the reaction and fluid supply as well as the amount of fluids used in the reaction. Since it may be desirable to analyze different properties of the final product, it would have been obvious to one of ordinary skill in this art at the time this invention was made to provide the method step of observing a reaction by the claimed well-known detectors or analyzers. Since it may be desirable perform reactions of different phases requiring different phases of fluid, it would have been obvious to one of ordinary skill in this art at the time this invention was made to provide the claimed method step of supplying different materials.

Claims 1, 3-25, and 27-43 meet the criteria set out in PCT Article 33(4), and thus meet industrial applicability because the subject matter claimed can be made or used in industry.

Applicant's arguments, filed 07-July-2004, have been fully considered and found unpersuasive. Specifically, applicant has argued that the references relied upon do not disclose capabilities of operation at high pressures. However, the instant claims recite merely a broad range of pressure operation, which range encompasses atmospheric pressure. The pressure operability and capability of the prior art devices and methods clearly fall within the presently recited range.

## ----- NEW CITATIONS -----

US 5,472,672 A (BRENNAN) 5 December 1995, see entire document.